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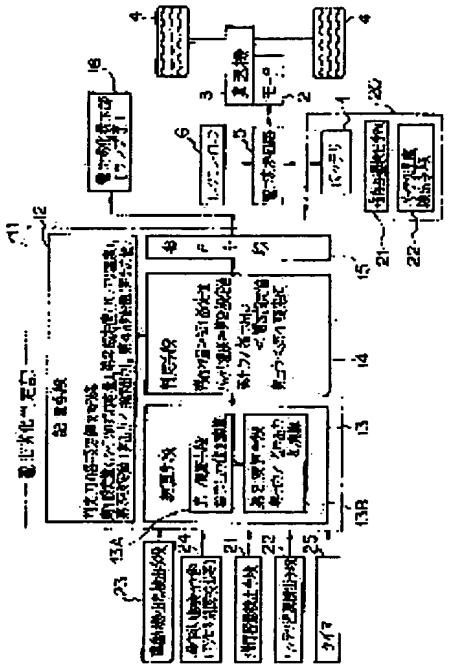
(54) ELECTRIC VEHICLE

(57)Abstract:
PROBLEM TO BE SOLVED: To judge the deterioration of a battery with driver's less feeling of oddness by judging the degree of deterioration of the battery, on the basis of the ratio of a real output to an indicating output value being an output value to be generated by a motor.
SOLUTION: A computing means 13 is provided with a first computing means 13A and a second computing means 13B. The first computing means 13A calculates an indicating output value being an output value to be generated by a motor 2 on the basis of a detected result by an operating state detecting means 24, and in general an indicating output value is calculated in accordance with the opening of an accelerator which a driver operates. The second computing means 13B divides a real output value detected by a motor output detecting means 23 by the indicating output value, and computes a ratio to the indicating output value, the real output value/the indicating output value. Besides, a judging means 14 performs judgment concerning each deterioration condition, on the basis of each judged value stored in a storage means 12 and the computed result by the computing means 13.



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CLAIMS

[Claim(s)]
[Claim 1] In the electric vehicle which offered the battery equipment which has the dc-battery carried in the car, and the motor with which the output shaft was connected with the driving wheel of this car while connecting with this dc-battery electrically A motor-output detection means to detect the value of the real output generated in this motor, and an actuation condition detection means to detect the actuation condition of the operator of this car, A 1st operation means to calculate the directions output value which is an output value which this motor is made to generate based on the detection result by this actuation condition detection means, The electric vehicle characterized by establishing a judgment means to judge the degradation degree of this dc-battery based on a 2nd operation means to calculate the rate of this real output value to this directions output value, and this real output value and this rate.
[Claim 2] The electric vehicle according to claim 1 which has a remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, and is characterized by judging this degradation degree when the remaining capacity value with which this judgment means was detected with this remaining capacity detection means is the 1st more than set point set up beforehand.
[Claim 3] The electric vehicle according to claim 1 which this battery device has a dc-battery temperature detection means to detect the temperature of this dc-battery, and is characterized by judging this degradation degree when the temperature value with which this judgment means was detected with this dc-battery temperature detection means is the 2nd more than set point set up beforehand.
[Claim 4] The electric vehicle according to claim 1 characterized by judging with this dc-battery having deteriorated when this judgment means is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand.
[Claim 5] The electric vehicle according to claim 4 characterized by this 4th set point being a value defined based on the temperature value detected with this dc-battery temperature detection means.
[Claim 6] A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand The temperature value detected with this dc-battery temperature detection means more than with and the 2nd set point set up beforehand And the electric vehicle according to claim 1 characterized by judging with this dc-battery having deteriorated when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand.
[Claim 7] A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand And the electric vehicle according to claim 1 characterized by judging with this dc-battery having deteriorated when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand.
[Claim 8] this judgment means -- this real output value -- predetermined time continuation -- carrying out -- this -- the electric vehicle according to claim 4 to 7 characterized by judging with this dc-battery having deteriorated when it is the 4th less than set point.
[Claim 9] This predetermined time is an electric vehicle according to claim 8 characterized by being the time amount for about 3 seconds preferably.

[Claim 10] The electric vehicle according to claim 1 characterized by establishing a display means to display this judgment result if it is judged that this dc-battery has deteriorated with this judgment means.
[Claim 11] While being constituted so that this judgment may be performed when the ignition key switch with which this judgment means was formed in this car is an ON state It has the judgment result storage section which memorizes the judgment result of the purport in which this dc-battery has deteriorated. When the judgment result of the purport to which this dc-battery has deteriorated before the last off change-over in this judgment result storage section is memorized at the time of the change-over to an ON state from OFF of this ignition key switch The electric vehicle according to claim 10 characterized by being constituted so that the purport in which this dc-battery has deteriorated may be displayed on this display means, without performing this judgment actuation.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention] This invention relates to the electric vehicle which has the function to judge the degradation condition of the dc-battery especially carried in the car about the electric vehicle which drives and runs a wheel with a motor.
[0002]
[Description of the Prior Art] Although an electric vehicle is attracting attention from prevention of air pollution or a viewpoint of the noise reduction by the car in recent years, in such an electric vehicle, it runs by operating the motor for transit using the power energy of the dc-battery carried in the car. The dc-battery for transit of this mount is used repeating charge and discharge, as it charges with an external battery charger etc., if power is supplied to a motor and it discharges to it.
[0003] Therefore, although endurance which does not deteriorate even if it repeats much charges and discharges is required of such a dc-battery for transit, by the present dc-battery engine performance, if much charges and discharges are repeated, it will surely deteriorate, and it becomes impossible to charge the power of sufficient capacity, and charging efficiency will fall. Then, although the judgment of degradation of such a dc-battery for transit is performed from before, the degradation judging of the conventional dc-battery for transit is performed by [as being the following] based on the dc-battery property produced at the time of degradation of a dc-battery. That is, when ** dc-battery is beyond a predetermined charging rate, ** dc-battery is below the predetermined dc-battery discharge current and ** dc-battery is below a predetermined electrical potential difference, it judges with the dc-battery having deteriorated.
[0004]
[Problem(s) to be Solved by the Invention] However, the following technical problems occur in the degradation diagnosis of the above-mentioned conventional dc-battery for transit. That is, ** of above-mentioned criteria and **s are the requirements for the dc-battery itself, and the operator itself cannot take in the degradation property of such a dc-battery itself directly. For this reason, in the judgment by such criteria, it is hard to double a judgment result with whenever [dc-battery degradation / which an operator senses], and there is a possibility of giving an operator sense of incongruity.
[0005] Moreover, since the internal resistance of a dc-battery rises when [, such as winter,] dc-battery temperature is low, even if the dc-battery has not deteriorated in fact, there is a possibility that ** of above-mentioned criteria and ** may be materialized. As it was originated in view of the above-mentioned technical problem and this invention is doubled with whenever [dc-battery degradation / whose operator senses a dc-battery degradation judging], it aims at offering the electric vehicle which enabled it to perform little dc-battery degradation judging of sense of incongruity to an operator.
[0006]
[Means for Solving the Problem] For this reason, the electric vehicle of this invention according to claim 1 In the electric vehicle which offered the battery equipment which has the dc-battery carried in the car, and the motor with which the output shaft was connected with the driving wheel of this car while connecting with this dc-battery electrically A motor-output detection means to detect the value of the real output generated in this motor, and an actuation condition detection means to detect the actuation condition of the operator of this car, A 1st operation means to calculate the directions output value which is an output value which this motor is made to generate based on the detection result by this actuation condition detection means, It is characterized by establishing a judgment means to judge the degradation degree of this dc-battery based on a 2nd operation means to calculate the rate of this real output value to this directions output value, and this real output value and this rate.

[0007] In the configuration according to claim 1, the electric vehicle of this invention according to claim 2 has a remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, and when the remaining capacity value with which this judgment means was detected with this remaining capacity detection means is the 1st more than set point set up beforehand, it is characterized by judging this degradation degree.
[0008] In the configuration according to claim 1, this battery device has a dc-battery temperature detection means to detect the temperature of this dc-battery, and the electric vehicle of this invention according to claim 3 is characterized by judging this degradation degree, when the temperature value with which this judgment means was detected with this dc-battery temperature detection means is the 2nd more than set point set up beforehand. In the configuration according to claim 1, the electric vehicle of this invention according to claim 4 is characterized by judging with this dc-battery having deteriorated, when this judgment means is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand.
[0009] The electric vehicle of this invention according to claim 5 is characterized by this 4th set point being a value defined based on the temperature value detected with this dc-battery temperature detection means in the configuration according to claim 4. The electric vehicle of this invention according to claim 6 is set in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand The temperature value detected with this dc-battery temperature detection means more than with and the 2nd set point set up beforehand And when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand, it is characterized by judging with this dc-battery having deteriorated.
[0010] The electric vehicle of this invention according to claim 7 is set in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand And when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand, it is characterized by judging with this dc-battery having deteriorated.
[0011] the electric vehicle of this invention according to claim 8 -- a configuration according to claim 4 to 7 -- setting -- this judgment means -- this real output value -- predetermined time continuation -- carrying out -- this -- when it is the 4th less than set point, it is characterized by judging with this dc-battery having deteriorated. In the configuration according to claim 8, this predetermined time is desirable and the electric vehicle of this invention according to claim 9 is characterized by being the time amount for about 3 seconds.

[0012] In the configuration according to claim 1, the electric vehicle of this invention according to claim 10 is characterized by establishing a display means to display this judgment result, if it is judged that this dc-battery has deteriorated with this judgment means. While the electric vehicle of this invention according to claim 11 is constituted so that this judgment may be performed when the ignition key switch with which this judgment means was formed in this car is an ON state in a configuration according to claim 10 It has the judgment result storage section which memorizes the judgment result of the purport in which this dc-battery has deteriorated. When the judgment result of the purport to which this dc-battery has deteriorated before the last off change-over in this judgment result storage section is memorized at the time of the change-over to an ON state from OFF of this ignition key switch It is characterized by being constituted so that the purport in which this dc-battery has deteriorated may be displayed on this display means, without performing this judgment actuation.
[0013]
[Embodiment of the Invention] The block diagram in which drawing 1 and drawing 2 show the electric vehicle as the 1st operation gestalt of this invention with a drawing, and drawing 1 shows the important section configuration typically with it hereafter when the gestalt of operation of this invention is explained, and drawing 2 are flow charts which show the procedure of the cell degradation judging.
[0014] If the configuration of this electric vehicle is explained, in drawing 1 , 1 is a mounted dc-battery and this dc-battery 1 can be repeatedly charged with the external battery charger with which a car is not

equipped. 2 is a motor (drive motor) to which power is supplied from a dc-battery 1, and the driving wheel 4 is connected with the output shaft of this motor 2 through the change gear 3. And the power inverter circuit 5 is formed between the dc-battery 1 and the motor 2, and the power from a dc-battery 1 is adjusted to necessary magnitude through this power inverter circuit 5, and is supplied to a motor 2. Moreover, a power inverter circuit 5 is controlled through the motor controller 6. At the time of treading in of the accelerator pedal which is not illustrated, when the output of a motor 2 is controlled through a power inverter circuit 5 according to the amount of treading in of an accelerator pedal and it does not get into the accelerator pedal, according to the amount of treading in of the brake pedal which is not illustrated, the amount of regeneration of a motor 2 is controlled by this motor controller 6 through a power inverter circuit 5.

[0015] By the way, a general remaining capacity detection means (common knowledge) 21 to detect the rate (charging rate) to the amount of full charges of the power capacity which remains in the dc-battery 1, and a general dc-battery temperature detection means (common knowledge) 22 to detect the temperature of a dc-battery 1 are attached to the dc-battery 1, and what included these remaining capacity detection means 21 and the dc-battery temperature detection means 22 in the dc-battery 1 will be called battery equipment 20.

[0016] And in order to judge degradation of such a dc-battery 1, the cell degradation judging section 11 is offered. This cell degradation judging section 11 has offered a storage means 12, an operation means 13, a judgment means 14, and a directions means 15, and it judges based on each detection information from an actuation condition detection means 24 detect the output actuation condition of drivers, such as the motor-output detection means 23 and accelerator opening, detect the output of a motor 1 and the remaining-capacity detection means 21 of battery equipment 20, and a dc-battery temperature detection means 22, and the timer information on a timer 25.

[0017] In addition, the motor-output detection means 23 is detectable based on the supply current value to a motor 1. The various set points for a judgment are memorized by the storage means 12. Specifically The set point (decision value) about the remaining capacity of a dc-battery is memorized as the 1st set point. The set point (decision value) about the temperature of a dc-battery is memorized as the 2nd set point. The set point (decision value) about the value (real output / directions output) of the ratio of the real output of a motor and a directions output is memorized as the 3rd set point, and the set point (decision value) about the real output of a motor is memorized as the 4th set point.

[0018] 1st operation means 13A and 2nd operation means 13B are prepared in the operation means 13. In 1st operation means 13A, the directions output value which is an output value which a motor 1 is made to generate based on the detection result by the actuation condition detection means 24 is calculated, and a directions output value can be computed corresponding to the opening (accelerator opening) of the accelerator pedal which a driver generally operates. In 2nd operation means 13B, the division of the real output value detected with the motor-output detection means 23 is done with a directions output value like a degree type, and the rate R of a real output value to a directions output value is calculated.

R= real outgo force value / directions output value, and the judgment means 14 judge about each degradation conditions based on the result of an operation by each decision value and the operation means 13 which were memorized by the storage means 12. That is, the judgment with the larger remaining capacity of the (a) dc-battery than the 1st set point (remaining capacity decision value), (b) The judgment with the larger temperature of a dc-battery than the 2nd set point (a dc-battery temperature decision value and a metaphor are 10-degreeC), (c) The judgment with the value R (real output / directions output) of the ratio of the real output of a motor, and a directions output smaller than the 3rd set point (decision value of real output / directions output), (d) The judgment of whether the condition that the real output of a motor is smaller than the 4th set point (motor real outgo force decision value) is continuing beyond predetermined time (for example, about 3 seconds) is performed, respectively. In addition, the judgment of (d) is performed based on the timer information on a timer 25.

[0019] The judgment of the dc-battery remaining capacity of (a) is a judgment about the prerequisite for which the conventional dc-battery degradation judging was also used among such each judgment, and since degradation criteria may be fulfilled even if the dc-battery has not deteriorated in fact, since the internal resistance of a dc-battery rises when [, such as winter,] dc-battery temperature is low, the judgment about the dc-battery temperature of (b) tends to except this.

[0020] Moreover, the judgment about the value (comparatively) R of the ratio of the real output of the (c) motor and a directions output and the judgment about the real output of the (d) motor are judgments about the degradation condition of a dc-battery, and are the criteria with which the feeling whose driver senses all, and a degradation judging were doubled. When a dc-battery deteriorates, the real output of a motor may stop among these, reaching to the directions output of a motor as the one phenomenon, if the judgment of (c) is

explained. that is, the directions output of a motor -- receiving -- the real output of a motor -- R becomes smaller than 1 comparatively and there is an output rate (real output / directions output) R of such a motor -- if it becomes moderately small, a driver will come to sense the lack of an output. Then, the decision value (the 3rd set point) about R of this output can be comparatively judged as the dc-battery having deteriorated, responding to the feeling which a driver senses the lack of an output such and a driver senses by the judgment of (c) by setting it as a value which is usually sensed that transit is impossible. When the effect of car weight, such as for example, a climb way, is added especially, the dc-battery degradation judging by this judgment is easy to be performed.

[0021] Moreover, if the judgment of (d) is explained, and a dc-battery deteriorates, a limitation will be generated in the magnitude of the real output of a motor itself as the one phenomenon. Then, it can judge with the dc-battery having deteriorated by setting the decision value (the 4th set point) about a real output value as a value which a driver senses the lack of an output to the magnitude of the real output of a motor, and is usually sensed that transit is impossible, responding to the feeling which a driver senses by the judgment of (d).

[0022] With this judgment means 14, when the output rate R was judged to be below a design value, and predetermined time (for example, about 3 seconds) continuation is carried out and a real output is judged by the judgment of (d) by the judgment of (c) under the situation that the result of affirmation is obtained by the judgment of (a) and (b), respectively to be below a design value, it judges with the dc-battery 1 having deteriorated. And with the directions means 15, if the degradation judging of the dc-battery 1 in the judgment means 14 is received, display directions will be outputted to the display 16 of cell degradation constituted, for example with the warning lamp etc.

[0023] Since the electric vehicle as the 1st operation gestalt of this invention is constituted as mentioned above, it can judge degradation of a dc-battery according to a flow chart as shown, for example in drawing 2 . First that is, by the judgment (step A10) of ignition key (IG key)-on Will start judgment control, if the IG key is ON, and progress to step A20, and it judges whether the last IG key shows cell degradation before off. If cell degradation is displayed, that (cell degradation) will be displayed on the cell degradation display 16 through the directions means 15, without performing judgment actuation (step A70).

[0024] Moreover, if judged with not displaying cell degradation last time at step A20 next, it will be judged at step A30 whether the remaining capacity (charging rate) of a dc-battery 1 is larger than the set point (the 1st set point). Since a right degradation judging cannot be performed if a charging rate is not larger than the set point, a judgment is not performed. If a charging rate is larger than the set point, it will progress to step A40 further, and it will be judged whether set point (the 2nd set point) ** also has the large temperature of a dc-battery 1. Since a right degradation judging cannot be performed if dc-battery temperature is not larger than the set point, a judgment is not performed. And if dc-battery temperature is larger than the set point, it will progress to step A50 further, and will judge whether the value (real output / directions output) R of the ratio of the real output of a motor 1 and a directions output is smaller than the 3rd set point (decision value of real output / directions output).

[0025] Here, if R (real output / directions output) is not smaller than the set point, it can judge with the dc-battery having not deteriorated. On the other hand, although it can judge with the dc-battery having deteriorated if R (real output / directions output) is smaller than the set point, it progresses to step A60 further in this case, and the judgment of whether the condition that the real output of a motor 1 was smaller than the set point carried out predetermined time (for example, 3 seconds) continuation is performed.

[0026] And if not judged with the condition that the real output of a motor 1 was smaller than the set point having carried out predetermined time (for example, 3 seconds) continuation, since it cannot conclude that the dc-battery has deteriorated, this judgment control is finished here. If judged with on the other hand the condition that the real output of a motor 1 was smaller than the set point having carried out predetermined time (for example, 3 seconds) continuation, if the dc-battery has deteriorated, it will come to a conclusion, and that (cell degradation) will be displayed on the cell degradation display 16 through the directions means 15 (step A70).

[0027] In addition, at the time of a changing battery, such a flow chart is reset and starts degradation judging control from a condition without a cell display after a changing battery. Thus, since the consciousness of drivers, such as R (real output / directions output) and the real output itself, and the parameter which is easy to adjust are used for the degradation judging of a dc-battery in this electric vehicle, the degradation judging of a dc-battery comes to match with the feeling which a driver senses, and it can be convinced to the degradation display of a dc-battery in a driver. It can appeal to a driver that this exchanges the dc-battery which deteriorated more promptly.

[0028] Moreover, with this operation gestalt, since it has judged with the dc-battery having deteriorated for the first time when both both are materialized by making the degradation conditions about R (real output / directions output), and the degradation conditions about the real output itself into AND conditions, fear of an incorrect judging is reduced so much. Moreover, about the degradation conditions about the real output itself, since the real output value is considering as the case where the condition below a predetermined value continues beyond predetermined time, fear of an incorrect judging is reduced also at this point.
[0029] Moreover, since the degradation degradation judging which was mistaken when dc-battery temperature was low is no longer performed, there is also no possibility of giving misunderstanding to a driver. Depending on of course, a setup of a decision value (each set point) and the reliability of each parameter The degradation conditions about R and the degradation conditions about the real output itself are made into OR conditions. (Real output / directions output) Various criteria, such as judging with the dc-battery having deteriorated etc. combining partially conditions (a), (b), (c), and (d), and considering as AND conditions, if one of degradation conditions is satisfied, and also considering as OR conditions, can be considered.
[0030] Moreover, although it is desirable that a real output value considers as the case where the condition below a predetermined value continues beyond predetermined time about the judgment of the degradation conditions whose real output values are below predetermined values in order to secure the dependability of a judgment, the decision value of the duration in this case is not limited to about 3 seconds like this operation gestalt. Next, since it is going to perform a more accurate dc-battery degradation judging and this operation gestalt is consisted of by being shown in drawing 1 like the 1st operation gestalt except for a part of this dc-battery degradation judging using the relation between cell temperature and the real output of a motor when the 2nd operation gestalt of this invention is explained, only a different point from the 1st operation gestalt is explained.
[0031] That is, when the following monograph affairs are filled with the judgment means 14 of the cell degradation judging section 11 in the electric vehicle of this operation gestalt to coincidence, it judges with the dc-battery having deteriorated. That is, the remaining capacity of the (a) dc-battery is larger than the 1st set point (remaining capacity decision value). And the value R of the ratio of the real output of the (c) motor and a directions output (real output / directions output) is smaller than the 3rd set point (decision value of real output / directions output). And when the condition that the real output of the (e) motor is smaller than the 4th set point (motor real outgo force decision value) according to the temperature of a dc-battery carries out predetermined time (for example, 3 seconds) continuation, it judges with the dc-battery having deteriorated.
[0032] Above-mentioned conditions (a) and (c) are the same as that of the 1st operation gestalt, and conditions (e) have become what compounded the conditions (b) in the 1st operation gestalt, and (d). Here, explanation of conditions (e) determines the 4th set point (motor real outgo force decision value) first according to the temperature of a dc-battery for the judgment of this condition (e). That is, dc-battery temperature and the property of corresponding have the motor real outgo force in drawing 3 so that it may be shown. In addition, a characteristic ray B is related with a nickel system cell by the characteristic ray A about a lead cell among drawing 3 .
[0033] By using such a property as a map or a table, and memorizing for the storage means 12, the 4th set point (motor real outgo force decision value) can be set up based on dc-battery temperature. Thus, if the 4th set point (motor real outgo force decision value) is set up, conditions (e) can be judged based on the real output of a motor.
[0034] Since the electric vehicle as the 2nd operation gestalt of this invention is constituted as mentioned above, it can judge degradation of a dc-battery according to a flow chart as shown, for example in drawing 4 . First that is, by the judgment (step B10) of ignition key (IG key)-on Will start judgment control, if the IG key is ON, and progress to step B20, and it judges whether the last IG key shows cell degradation before off. If cell degradation is displayed, that (cell degradation) will be displayed on the cell degradation display 16 through the directions means 15, without performing judgment actuation (step B70).
[0035] Moreover, if judged with not displaying cell degradation last time at step B20 next, it will be judged at step B30 whether the remaining capacity (charging rate) of a dc-battery 1 is larger than the set point (the 1st set point). Since a right degradation judging cannot be performed if a charging rate is not larger than the set point, a judgment is not performed. If a charging rate is larger than the set point, it will progress to step B40 further, and will judge whether the value (real output / directions output) R of the ratio of the real output of a motor 1 and a directions output is smaller than the 3rd set point (decision value of real output / directions output).

[0036] Here, if R (real output / directions output) is not smaller than the set point, it can judge with the dc-battery having not deteriorated. On the other hand, although it can judge with the dc-battery having deteriorated if R (real output / directions output) is smaller than the set point In this case, progress to step B50 further, and the 4th set point (motor real outgo force decision value) is calculated and set up based on the temperature of a dc-battery 1. Furthermore it progresses to step B60, and the judgment of whether the condition that the real output of a motor 1 was smaller than the 4th set point (motor real outgo force decision value) set up at step B50 carried out predetermined time (for example, 3 seconds) continuation is performed.

[0037] And if not judged with the condition that the real output of a motor 1 was smaller than the set point having carried out predetermined time (for example, 3 seconds) continuation, since it cannot conclude that the dc-battery has deteriorated, this judgment control is finished here. If judged with on the other hand the condition that the real output of a motor 1 was smaller than the set point having carried out predetermined time (for example, 3 seconds) continuation, if the dc-battery has deteriorated, it will come to a conclusion, and that (cell degradation) will be displayed on the cell degradation display 16 through the directions means 15 (step B70).

[0038] In addition, at the time of a changing battery, such a flow chart is reset and starts degradation judging control from a condition without a cell display after a changing battery. Thus, since the consciousness of drivers, such as R (real output / directions output) and the real output itself, and the parameter which is easy to adjust are used for the degradation judging of a dc-battery also with this electric vehicle, the degradation judging of a dc-battery comes to match with the feeling which a driver senses, and it can be convinced to the degradation display of a dc-battery in a driver. It can appeal to a driver that this exchanges the dc-battery which deteriorated more promptly.

[0039] Moreover, with this operation gestalt, since it has judged with the dc-battery having deteriorated for the first time when both both are materialized by making the degradation conditions about R (real output / directions output), and the degradation conditions about the real output itself into AND conditions, fear of an incorrect judging is reduced so much. Moreover, about the degradation conditions about the real output itself, since the real output value is considering as the case where the condition below a predetermined value continues beyond predetermined time, fear of an incorrect judging is reduced also at this point.

[0040] Moreover, since the 4th set point (motor real outgo force decision value) is set up according to dc-battery temperature based on the property of a dc-battery, there is an advantage to which a degradation judging is moreover carried out with a more sufficient precision according to the feeling of a driver. Moreover, since the degradation degradation judging which was mistaken when dc-battery temperature was low is no longer performed, there is also no possibility of giving misunderstanding to a driver.

[0041] Also with this operation gestalt, of course, depending on a setup of a decision value (each set point), or the reliability of each parameter The degradation conditions about R and the degradation conditions about the real output itself are made into OR conditions. (Real output / directions output) Various criteria, such as judging with the dc-battery having deteriorated etc. combining conditions (A), (B), and (E) partially, and considering as AND conditions, if one of degradation conditions is satisfied, and also considering as OR conditions, can be considered.

[0042] Moreover, although it is desirable that a real output value considers as the case where the condition below a predetermined value continues beyond predetermined time, also with this operation gestalt in order to secure the dependability of a judgment about the judgment of the degradation conditions whose real output values are below predetermined values, the decision value of the duration in this case is not limited to about 3 seconds like this operation gestalt. Moreover, the degradation judging of the dc-battery by this electric vehicle can be applied to various kinds of electric vehicles, such as an electric vehicle, various hybrid electric vehicles, etc. which do not offer a change gear, without being limited to the electric vehicle of a configuration as shown in drawing 1 .

[0043]

[Effect of the Invention] As explained in full detail above, according to the electric vehicle of this invention according to claim 1 In the electric vehicle which offered the battery equipment which has the dc-battery carried in the car, and the motor with which the output shaft was connected with the driving wheel of this car while connecting with this dc-battery electrically A motor-output detection means to detect the value of the real output generated in this motor, and an actuation condition detection means to detect the actuation condition of the operator of this car, A 1st operation means to calculate the directions output value which is an output value which this motor is made to generate based on the detection result by this actuation condition detection means, By the configuration that a judgment means to judge the degradation degree of

this dc-battery based on a 2nd operation means to calculate the rate of this real output value to this directions output value, and this real output value and this rate is established The degradation judging of a dc-battery can be performed now according to the feeling of a driver, and a driver can be convinced now of the degradation display of a dc-battery etc. There is an advantage which can be promoted to a driver so that this may exchange the dc-battery which deteriorated more promptly.

[0044] According to the electric vehicle of this invention according to claim 2, it sets in a configuration according to claim 1. It has a remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity. When the remaining capacity value with which this judgment means was detected with this remaining capacity detection means is the 1st more than set point set up beforehand, there is an advantage which can perform the degradation judging of a dc-battery with a sufficient precision by the configuration of judging this degradation degree, without producing an incorrect judging.

[0045] According to the electric vehicle of this invention according to claim 3, it sets in a configuration according to claim 1. This battery device has a dc-battery temperature detection means to detect the temperature of this dc-battery. When the temperature value with which this judgment means was detected with this dc-battery temperature detection means is the 2nd more than set point set up beforehand, there is an advantage which can perform the degradation judging of a dc-battery with a sufficient precision by the configuration of judging this degradation degree, without producing an incorrect judging.

[0046] When according to the electric vehicle of this invention according to claim 4 this judgment means is the 3rd less than set point to which this rate was set beforehand in a configuration according to claim 1 and this real output value is the 4th less than set point set up beforehand, moreover, the configuration of judging with this dc-battery having deteriorated can perform the degradation judging of a dc-battery with a sufficient precision according to the feeling of a driver.

[0047] According to the electric vehicle of this invention according to claim 5, in a configuration according to claim 4, the configuration that this 4th set point is defined based on the temperature value detected with this dc-battery temperature detection means can perform the degradation judging of a dc-battery now with a moreover more sufficient precision according to the feeling of a driver. According to the electric vehicle of this invention according to claim 6, it sets in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand The temperature value detected with this dc-battery temperature detection means more than with and the 2nd set point set up beforehand By and the configuration of judging with this dc-battery having deteriorated when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand Moreover, the degradation judging of a dc-battery can be performed now with a sufficient precision according to the feeling of a driver. It can promote to a driver so that a driver may be convinced of the degradation display of a dc-battery etc., it may come by this and the dc-battery which deteriorated may be exchanged more promptly.

[0048] According to the electric vehicle of this invention according to claim 7, it sets in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand And when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand, the configuration of judging with this dc-battery having deteriorated can perform the degradation judging of a dc-battery with a sufficient precision according to the feeling of a driver. It can promote to a driver so that a driver may be convinced of the degradation display of a dc-battery etc., it may come by this and the dc-battery which deteriorated may be exchanged more promptly.

[0049] according to the electric vehicle of this invention according to claim 8 -- a configuration according to claim 4 to 7 -- setting -- this judgment means -- this real output value -- predetermined time continuation -- carrying out -- this -- the configuration of judging with this dc-battery having deteriorated when it is the 4th less than set point -- the degradation judging of a dc-battery -- misjudgment -- there is an advantage which can be performed now with a sufficient precision, without producing a law.

[0050] According to the electric vehicle of this invention according to claim 9, in a configuration according

to claim 8, this predetermined time has the advantage which can perform the degradation judging of a dc-battery often [precision] and promptly by the configuration that it is the time amount for about 3 seconds preferably, without producing an incorrect judging. According to the electric vehicle of this invention according to claim 10, in a configuration according to claim 1, it can promote to a driver that this dc-battery has deteriorated with this judgment means so that the dc-battery which deteriorated may be more promptly exchanged by the configuration that a display means to display this judgment result will be established if judged.

[0051] While according to the electric vehicle of this invention according to claim 11 being constituted so that this judgment may be performed when the ignition key switch with which this judgment means was formed in this car is an ON state in a configuration according to claim 10 It has the judgment result storage section which memorizes the judgment result of the purport in which this dc-battery has deteriorated. When the judgment result of the purport to which this dc-battery has deteriorated before the last off change-over in this judgment result storage section is memorized at the time of the change-over to an ON state from OFF of this ignition key switch The configuration of being constituted so that the purport in which this dc-battery has deteriorated may be displayed on this display means, without performing this judgment actuation can perform the degradation judging of a dc-battery now efficiently more simply.

[Translation done.]

* NOTICES *

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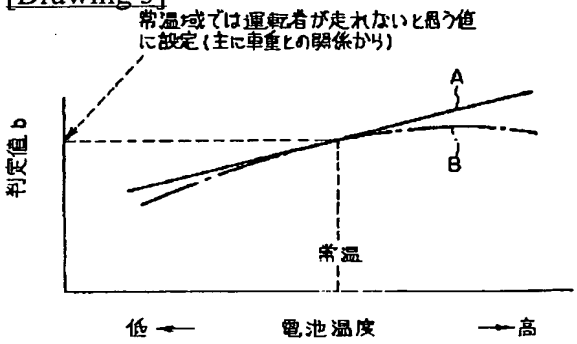
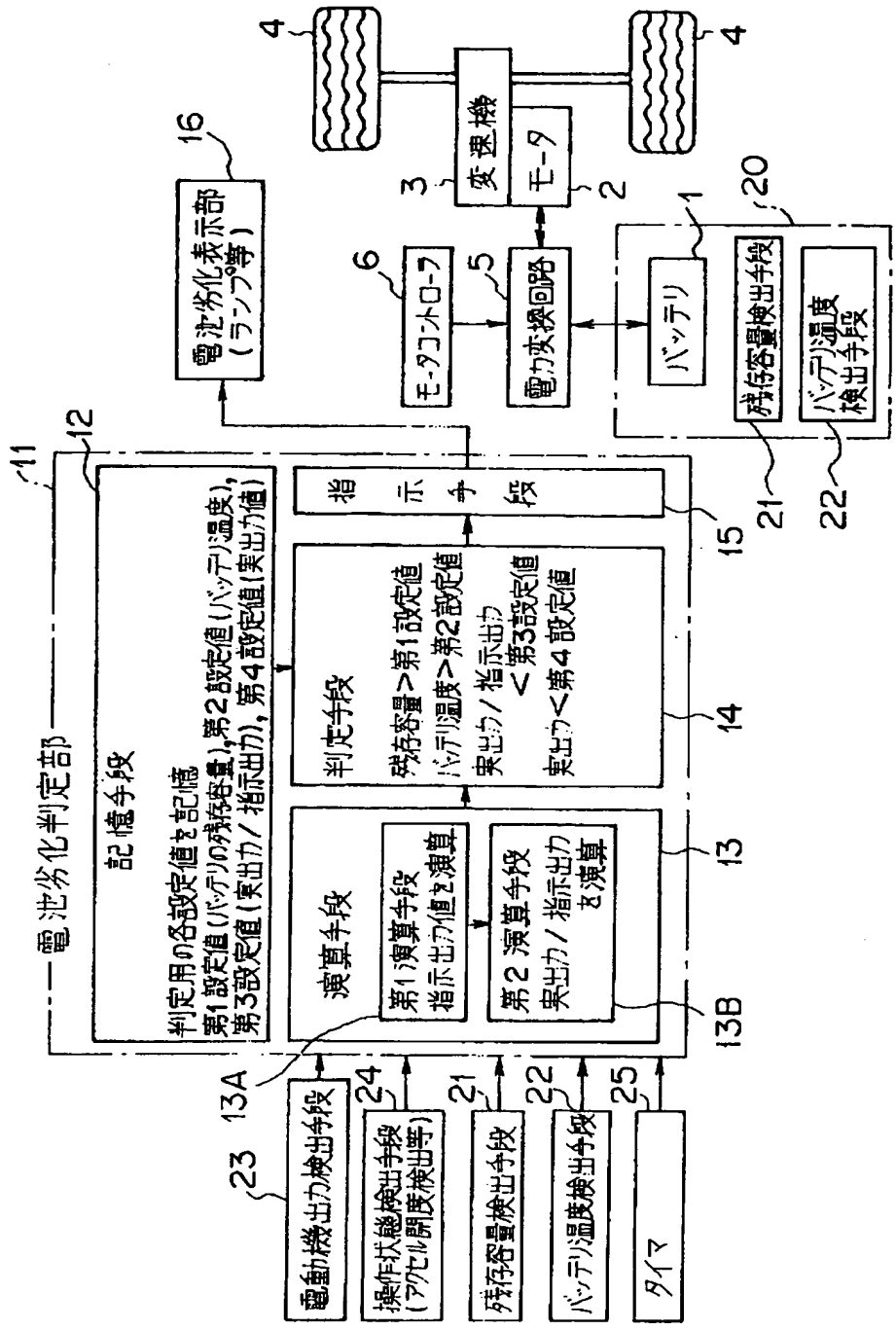
DRAWINGS

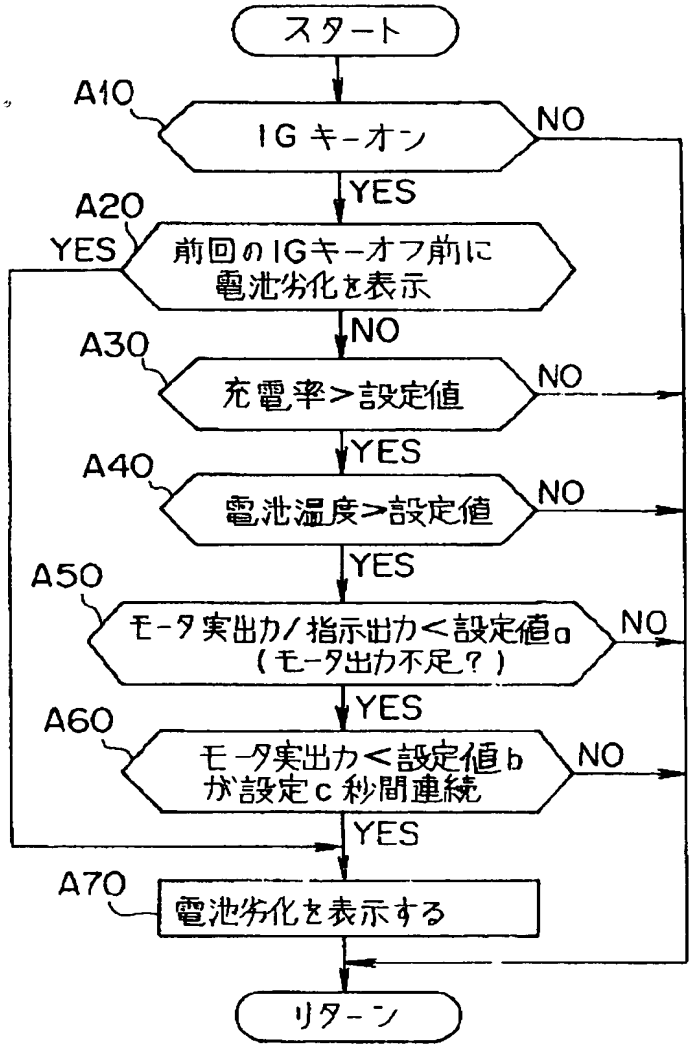
[Drawing 3]



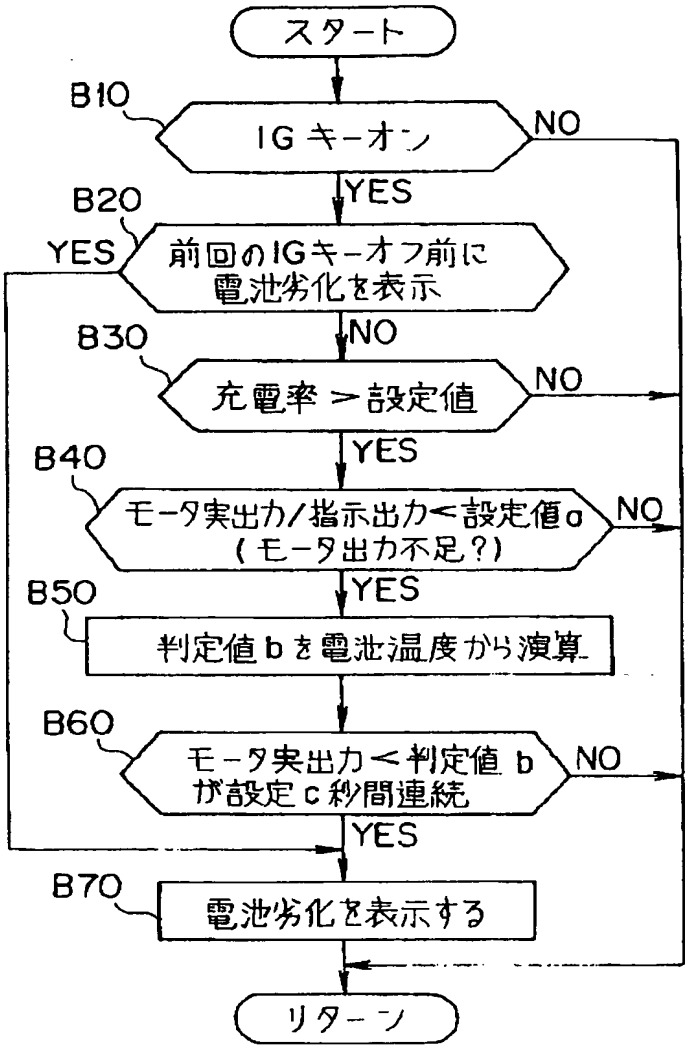
[Drawing 1]


電池劣化判定部
記憶手段
判定用の各設定値を記憶
第1設定値(バッテリの残容量),第2設定値(バッテリ温度),
第3設定値(実出力/指示出力),第4設定値(実出力値)
判定手段
残存容量>第1設定値
バッテリ温度>第2設定値
実出力/指示出力
<第3設定値
実出力<第4設定値
指示手段
演算手段
第1演算手段
指示出力値を演算
第2演算手段
実出力/指示出力
を演算
電動機出力検出手段
操作状態検出手段
(アクセル開度検出等)
残存容量検出手段
バッテリ温度検出手段
タイマ
電池劣化表示部
(ランプ等)
モータコントローラ
電力変換回路
バッテリ
残存容量検出手段
バッテリ温度
検出手段
変速機
モータ
11
12
13
13A
13B
14
15
16
20
21
22
23
24
25
1
2
3
4
5
6

[Drawing 2]


スタート
A10
IG キーオン
NO
YES
A20
YES
前回のIGキーオフ前に
電池劣化を表示
NO
A30
充電率>設定値
NO
YES
A40
電池温度>設定値
NO
YES
A50
モータ実出力/指示出力<設定値a
(モータ出力不足?)
NO
YES
A60
モータ実出力<設定値b
が設定c秒間連続
NO
YES
A70
電池劣化を表示する
リターン

[Drawing 4]



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CORRECTION OR AMENDMENT

[Kind of official gazette] Printing of amendment by the convention of 2 of Article 17 of Patent Law
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H01M 10/48
301

[FI]

B60L 3/00 S
H01M 10/48 P
301

[Procedure revision]
[Filing Date] September 18, Heisei 10
[Procedure amendment 1]
[Document to be Amended] Specification
[Item(s) to be Amended] Claim
[Method of Amendment] Modification
[Proposed Amendment]
[Claim(s)]
[Claim 1] The electric vehicle which offered the battery equipment which is characterized by providing the following, and which has the dc-battery carried in the car, and the motor with which the output shaft was connected with the driving wheel of this car while connecting with this dc-battery electrically A motor-output detection means to detect the value of the real output generated in this motor An actuation condition detection means to detect the actuation condition of the operator of this car A 1st operation means to calculate the directions output value which is an output value which this motor is made to generate based on the detection result by this actuation condition detection means A judgment means to judge the degradation degree of this dc-battery based on a 2nd operation means to calculate the rate of this real output value to this directions output value, and this real output value and this rate
[Claim 2] The electric vehicle according to claim 1 which has a remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, and is characterized by judging this degradation degree when the remaining capacity value with which this judgment means was detected with this remaining capacity detection means is the 1st more than set point set up beforehand.
[Claim 3] The electric vehicle according to claim 1 which this battery device has a dc-battery temperature detection means to detect the temperature of this dc-battery, and is characterized by judging this degradation degree when the temperature value with which this judgment means was detected with this dc-battery

temperature detection means is the 2nd more than set point set up beforehand.
[Claim 4] The remaining capacity value with which it had the following and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand The temperature value detected with this dc-battery temperature detection means more than with and the 2nd set point set up beforehand And the electric vehicle according to claim 1 characterized by judging with this dc-battery having deteriorated when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity A dc-battery temperature detection means to detect the temperature of this dc-battery
[Claim 5] The electric vehicle according to claim 1 characterized by judging with this dc-battery having deteriorated when it is the 1st more than set point to which the remaining capacity value with which it had the following and this judgment means was detected with this remaining capacity detection means was set beforehand, it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity A dc-battery temperature detection means to detect the temperature of this dc-battery
[Procedure amendment 2]
[Document to be Amended] Specification
[Item(s) to be Amended] 0008
[Method of Amendment] Modification
[Proposed Amendment]
[0008] In the configuration according to claim 1, this battery device has a dc-battery temperature detection means to detect the temperature of this dc-battery, and the electric vehicle of this invention according to claim 3 is characterized by judging this degradation degree, when the temperature value with which this judgment means was detected with this dc-battery temperature detection means is the 2nd more than set point set up beforehand. In addition, when this judgment means is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand, you may make it judge with this dc-battery having deteriorated in a configuration according to claim 1 (mode 1).
[Procedure amendment 3]
[Document to be Amended] Specification
[Item(s) to be Amended] 0009
[Method of Amendment] Modification
[Proposed Amendment]
[0009] In a mode 1, this 4th set point may be a value defined based on the temperature value detected with this dc-battery temperature detection means (mode 2). The electric vehicle of this invention according to claim 4 is set in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand The temperature value detected with this dc-battery temperature detection means more than with and the 2nd set point set up beforehand And when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand, it is characterized by judging with this dc-battery having deteriorated.
[Procedure amendment 4]
[Document to be Amended] Specification
[Item(s) to be Amended] 0010
[Method of Amendment] Modification
[Proposed Amendment]
[0010] The electric vehicle of this invention according to claim 5 is set in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand And when it is the 3rd less than set point to which this rate was set beforehand and this

real output value is the 4th less than set point set up beforehand, it is characterized by judging with this dc-battery having deteriorated.
[Procedure amendment 5]
[Document to be Amended] Specification
[Item(s) to be Amended] 0011
[Method of Amendment] Modification
[Proposed Amendment]
[0011] a configuration given in claims 4 and 5 or modes 1 and 2 -- setting -- this judgment means -- this real output value -- predetermined time continuation -- carrying out -- this -- when it is the 4th less than set point, you may make it judge with this dc-battery having deteriorated (mode 3) In a mode 3, it is desirable that this predetermined time is the time amount for about 3 seconds (mode 4).
[Procedure amendment 6]
[Document to be Amended] Specification
[Item(s) to be Amended] 0012
[Method of Amendment] Modification
[Proposed Amendment]
[0012] In a configuration according to claim 1, a judgment of that this dc-battery has deteriorated with this judgment means may establish a display means to display this judgment result (mode 5). While being constituted so that this judgment may be performed when the ignition key switch with which this judgment means was formed in this car is an ON state in a mode 5 It has the judgment result storage section which memorizes the judgment result of the purport in which this dc-battery has deteriorated. When the judgment result of the purport to which this dc-battery has deteriorated before the last off change-over in this judgment result storage section is memorized at the time of the change-over to an ON state from OFF of this ignition key switch It may be constituted so that the purport in which this dc-battery has deteriorated may be displayed on this display means, without performing this judgment actuation (mode 6).
[Procedure amendment 7]
[Document to be Amended] Specification
[Item(s) to be Amended] 0046
[Method of Amendment] Modification
[Proposed Amendment]
[0046] In a configuration according to claim 1, if it judges with this dc-battery having deteriorated when this judgment means is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand (mode 1), moreover, the degradation judging of a dc-battery can be performed with a sufficient precision according to the feeling of a driver.
[Procedure amendment 8]
[Document to be Amended] Specification
[Item(s) to be Amended] 0047
[Method of Amendment] Modification
[Proposed Amendment]
[0047] In a mode 1, if this 4th set point is defined based on the temperature value detected with this dc-battery temperature detection means (mode 2), the degradation judging of a dc-battery can be performed with a moreover more sufficient precision according to the feeling of a driver. According to the electric vehicle of this invention according to claim 4, it sets in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand The temperature value detected with this dc-battery temperature detection means more than with and the 2nd set point set up beforehand By and the configuration of judging with this dc-battery having deteriorated when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand Moreover, the degradation judging of a dc-battery can be performed now with a sufficient precision according to the feeling of a driver. It can promote to a driver so that a driver may be convinced of the degradation display of a dc-battery etc., it may come by this and the dc-battery which deteriorated may be exchanged more promptly.
[Procedure amendment 9]
[Document to be Amended] Specification

[Item(s) to be Amended] 0048
[Method of Amendment] Modification
[Proposed Amendment]
[0048] According to the electric vehicle of this invention according to claim 5, it sets in a configuration according to claim 1. A remaining capacity detection means by which this battery device detects the remaining capacity of the electrical and electric equipment which this dc-battery stores electricity, The remaining capacity value with which it has a dc-battery temperature detection means to detect the temperature of this dc-battery, and this judgment means was detected with this remaining capacity detection means more than with the 1st set point set up beforehand And when it is the 3rd less than set point to which this rate was set beforehand and this real output value is the 4th less than set point set up beforehand, the configuration of judging with this dc-battery having deteriorated can perform the degradation judging of a dc-battery with a sufficient precision according to the feeling of a driver. It can promote to a driver so that a driver may be convinced of the degradation display of a dc-battery etc., it may come by this and the dc-battery which deteriorated may be exchanged more promptly.
[Procedure amendment 10]
[Document to be Amended] Specification
[Item(s) to be Amended] 0049
[Method of Amendment] Modification
[Proposed Amendment]
[0049] a configuration given in claims 4 and 5 or modes 1 and 2 -- setting -- this judgment means -- this real output value -- predetermined time continuation -- carrying out -- this -- if it judges with this dc-battery having deteriorated when it is the 4th less than set point (mode 3) -- the degradation judging of a dc-battery -- misjudgment -- there is an advantage which can be performed now with a sufficient precision, without producing a law.
[Procedure amendment 11]
[Document to be Amended] Specification
[Item(s) to be Amended] 0050
[Method of Amendment] Modification
[Proposed Amendment]
[0050] In the configuration of a mode 3, there is an advantage which can be performed now often [precision] and promptly, without producing an incorrect judging for the degradation judging of a dc-battery as this predetermined time is the time amount for about 3 seconds (mode 4). In a configuration according to claim 1, if a display means to display this judgment result if it is judged that this dc-battery has deteriorated with this judgment means is established (mode 5), it can promote to a driver so that the dc-battery which deteriorated may be exchanged more promptly.
[Procedure amendment 12]
[Document to be Amended] Specification
[Item(s) to be Amended] 0051
[Method of Amendment] Modification
[Proposed Amendment]
[0051] While being constituted so that this judgment may be performed when the ignition key switch with which this judgment means was formed in this car is an ON state in the configuration of a mode 5 It has the judgment result storage section which memorizes the judgment result of the purport in which this dc-battery has deteriorated. When the judgment result of the purport to which this dc-battery has deteriorated before the last off change-over in this judgment result storage section is memorized at the time of the change-over to an ON state from OFF of this ignition key switch If it is constituted so that the purport in which this dc-battery has deteriorated may be displayed on this display means, without performing this judgment actuation (mode 6), the degradation judging of a dc-battery can be performed efficiently more simply.

[Translation done.]

(19)日本国特許庁（ＪＰ）　(12)**公開特許公報**（Ａ）　(11)特許出願公開番号

特開平9－98503

(43)公開日　平成９年(1997)４月８日

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Ｂ６０Ｌ　3/00			Ｂ６０Ｌ　3/00	Ｓ	
Ｈ０１Ｍ　10/48			Ｈ０１Ｍ　10/48	Ｐ	
	３０１			３０１	

審査請求　未請求　請求項の数11　ＯＬ　（全 11 頁）

(21)出願番号　特願平7－256647

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(71)出願人　000006286
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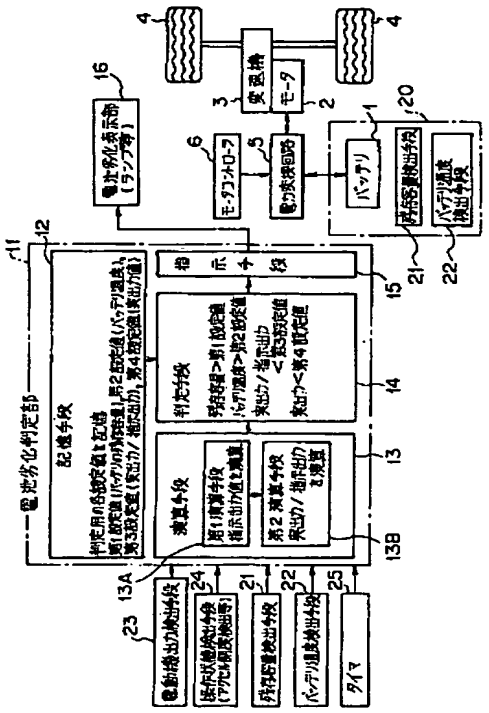
(74)代理人　弁理士　真田　有

(54)【発明の名称】　電気自動車

(57)【要約】

【課題】　本発明は、車両に搭載されたバッテリの劣化状態を判定する機能を有する電気自動車に関し、バッテリ劣化判定を運転者の感覚に合わせるようにして、運転者に違和感の少ないバッテリ劣化判定を行なえるようにする。

【解決手段】　車載のバッテリ１を有する蓄電池装置２０と、バッテリ１の電力により車両の駆動輪４を駆動する電動機２とをそなえ、電動機２に発生する実出力値を検出する電動機出力検出手段２３と、運転者の操作状態を検出する操作状態検出手段２４と、操作状態検出手段２４による検出結果に基づいて電動機２に発生させる指示出力値を演算する第１演算手段１３Ａと、指示出力値に対する実出力値の割合を演算する第２演算手段１３Ｂと、実出力値と該割合とに基づいて該バッテリの劣化度合を判定する判定手段１４とを設ける。



1

【特許請求の範囲】

【請求項１】　車両に搭載されているバッテリを有する蓄電池装置と、該バッテリに電気的に接続されるとともに出力軸を該車両の駆動輪に連結された電動機と、をそなえた電気自動車において、

該電動機に発生する実出力の値を検出する電動機出力検出手段と、

該車両の運転者の操作状態を検出する操作状態検出手段と、

該操作状態検出手段による検出結果に基づいて該電動機に発生させる出力値である指示出力値を演算する第１演算手段と、

該指示出力値に対する該実出力値の割合を演算する第２演算手段と、

該実出力値と該割合とに基づいて該バッテリの劣化度合を判定する判定手段とが設けられていることを特徴とする、電気自動車。

【請求項２】　該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段を有し、

該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上である場合に、該劣化度合の判定を実施することを特徴とする、請求項１記載の電気自動車。

【請求項３】　該蓄電池機構が、該バッテリの温度を検出するバッテリ温度検出手段を有し、

該判定手段が、該バッテリ温度検出手段で検出された温度値が予め設定された第２設定値以上である場合に、該劣化度合の判定を実施することを特徴とする、請求項１記載の電気自動車。

【請求項４】　該判定手段が、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴とする、請求項１記載の電気自動車。

【請求項５】　該第４設定値が、該バッテリ温度検出手段で検出された温度値に基づいて定められる値であることを特徴とする、請求項４記載の電気自動車。

【請求項６】　該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段と、該バッテリの温度を検出するバッテリ温度検出手段とを有し、

該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上で、且つ、該バッテリ温度検出手段で検出された温度値が予め設定された第２設定値以上で、且つ、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴とする、請求項１記載の電気自動車。

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【請求項７】　該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段と、該バッテリの温度を検出するバッテリ温度検出手段とを有し、

該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上で、且つ、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴とする、請求項１記載の電気自動車。

【請求項８】　該判定手段が、該実出力値が所定時間連続して該第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴とする、請求項４～７のいずれかに記載の電気自動車。

【請求項９】　該所定時間は、好ましくは３秒程度の時間であることを特徴とする、請求項８記載の電気自動車。

【請求項１０】　該判定手段により該バッテリが劣化していることが判定されるとこの判定結果を表示する表示手段が設けられていることを特徴とする、請求項１記載の電気自動車。

【請求項１１】　該判定手段が、

該車両に設けられたイグニッションキースイッチがオン状態のときに該判定を行なうように構成されるとともに、

該バッテリが劣化している旨の判定結果を記憶する判定結果記憶部を有し、

該イグニッションキースイッチのオフからオン状態への切換時に、該判定結果記憶部に前回のオフ切換前に該バッテリが劣化している旨の判定結果が記憶されている時には、該判定動作を行なわずに、該表示手段に該バッテリが劣化している旨を表示させるように構成されていることを特徴とする、請求項１０記載の電気自動車。

【発明の詳細な説明】

【０００１】

【発明の属する技術分野】本発明は、電動機によって車輪を駆動し走行する電気自動車に関し、特に、車両に搭載されたバッテリの劣化状態を判定する機能を有する、電気自動車に関する。

【０００２】

【従来の技術】近年、大気汚染の防止や車両による騒音低減の観点から、電気自動車が注目されつつあるが、このような電気自動車では、車両に搭載したバッテリの電力エネルギを利用して走行用電動機を作動させて走行する。この車載の走行用バッテリは、電動機に電力を供給して放電したら外部充電器等により充電を行なうようにして、充放電を繰り返しながら使用する。

【０００３】したがって、このような走行用バッテリには、多数の充放電を繰り返しても劣化しないような耐久性が要求されるが、現状のバッテリ性能では、多数の充

放電を繰り返すとどうしても劣化して、十分な容量の電力を充電することができなくなったり、充電効率が低下したりしてしまう。そこで、従来より、このような走行用バッテリの劣化の判定が行なわれているが、従来の走行用バッテリの劣化判定は、バッテリの劣化時に生じるバッテリ特性に基づいて以下のようにして行なわれる。つまり、①バッテリが所定の充電率以上であって、且つ、②バッテリが所定のバッテリ放電電流以下であって、且つ、③バッテリが所定の電圧以下である場合に、バッテリが劣化したと判定するのである。

【０００４】

【発明が解決しようとする課題】しかしながら、上述の従来の走行用バッテリの劣化判定法では、以下のような課題がある。つまり、上述の判定条件の②，③は、バッテリ自体の要件であり、運転者自身はこのようなバッテリ自体の劣化特性を直接感じとることはできない。このため、このような判定条件による判定では、判定結果が運転者が感じるバッテリ劣化度と合わせにくく、運転者に違和感を与えるおそれがある。

【０００５】また、冬季などバッテリ温度の低いときにはバッテリの内部抵抗が上昇するので、実際にはバッテリが劣化していなくても上述の判定条件の②，③が成立してしまうおそれがある。本発明は、上述の課題に鑑み創案されたもので、バッテリ劣化判定を運転者が感じるバッテリ劣化度と合わせるようにして、運転者に違和感の少ないバッテリ劣化判定を行なえるようにした、電気自動車を提供することを目的とする。

【０００６】

【課題を解決するための手段】このため、請求項１記載の本発明の電気自動車は、車両に搭載されているバッテリを有する蓄電池装置と、該バッテリに電気的に接続されるとともに出力軸を該車両の駆動輪に連結された電動機と、をそなえた電気自動車において、該電動機に発生する実出力の値を検出する電動機出力検出手段と、該車両の運転者の操作状態を検出する操作状態検出手段と、該操作状態検出手段による検出結果に基づいて該電動機に発生させる出力値である指示出力値を演算する第１演算手段と、該指示出力値に対する該実出力値の割合を演算する第２演算手段と、該実出力値と該割合とに基づいて該バッテリの劣化度合を判定する判定手段とが設けられていることを特徴としている。

【０００７】請求項２記載の本発明の電気自動車は、請求項１記載の構成において、該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段を有し、該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上である場合に、該劣化度合の判定を実施することを特徴としている。

【０００８】請求項３記載の本発明の電気自動車は、請求項１記載の構成において、該蓄電池機構が、該バッテリの温度を検出するバッテリ温度検出手段を有し、該判定手段が、該バッテリ温度検出手段で検出された温度値が予め設定された第２設定値以上である場合に、該劣化度合の判定を実施することを特徴としている。請求項４記載の本発明の電気自動車は、請求項１記載の構成において、該判定手段が、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴としている。

【０００９】請求項５記載の本発明の電気自動車は、請求項４記載の構成において、該第４設定値が、該バッテリ温度検出手段で検出された温度値に基づいて定められる値であることを特徴としている。請求項６記載の本発明の電気自動車は、請求項１記載の構成において、該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段と、該バッテリの温度を検出するバッテリ温度検出手段とを有し、該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上で、且つ、該バッテリ温度検出手段で検出された温度値が予め設定された第２設定値以上で、且つ、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴としている。

【００１０】請求項７記載の本発明の電気自動車は、請求項１記載の構成において、該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段と、該バッテリの温度を検出するバッテリ温度検出手段とを有し、該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上で、且つ、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴としている。

【００１１】請求項８記載の本発明の電気自動車は、請求項４～７のいずれかに記載の構成において、該判定手段が、該実出力値が所定時間連続して該第４設定値以下である場合に、該バッテリが劣化していると判定することを特徴としている。請求項９記載の本発明の電気自動車は、請求項８記載の構成において、該所定時間は、好ましくは３秒程度の時間であることを特徴としている。

【００１２】請求項１０記載の本発明の電気自動車は、請求項１記載の構成において、該判定手段により該バッテリが劣化していることが判定されるとこの判定結果を表示する表示手段が設けられていることを特徴としている。請求項１１記載の本発明の電気自動車は、請求項１０記載の構成において、該判定手段が、該車両に設けられたイグニッションキースイッチがオン状態のときに該判定を行なうように構成されるとともに、該バッテリが劣化している旨の判定結果を記憶する判定結果記憶部を

有し、該イグニッションキースイッチのオフからオン状態への切換時に、該判定結果記憶部に前回のオフ切換前に該バッテリが劣化している旨の判定結果が記憶されている時には、該判定動作を行なわずに、該表示手段に該バッテリが劣化している旨を表示させるように構成されていることを特徴としている。

【００１３】

【発明の実施の形態】以下、図面により、本発明の実施の形態について説明すると、図１，図２は本発明の第１実施形態としての電気自動車を示すもので、図１はその要部構成を模式的に示すブロック図、図２はその電池劣化判定の手順を示すフローチャートである。

【００１４】この電気自動車の構成を説明すると、図１において、１は車載のバッテリであり、このバッテリ１は車両に装備されない外部充電器により繰り返し充電することができる。２はバッテリ１から電力を供給される電動機（走行用モータ）であり、このモータ２の出力軸に変速機３を介して駆動輪４が連結されている。そして、バッテリ１とモータ２との間には電力変換回路５が設けられており、バッテリ１からの電力はこの電力変換回路５を通じて所要の大きさに調整されてモータ２へ供給されるようになっている。また、電力変換回路５は、モータコントローラ６を通じて制御されるようになっている。このモータコントローラ６では、図示しないアクセルペダルの踏込時には、アクセルペダルの踏込量に応じて電力変換回路５を通じてモータ２の出力を制御し、アクセルペダルが踏み込まれていない場合には、図示しないブレーキペダルの踏込量に応じて電力変換回路５を通じてモータ２の回生量を制御するようになっている。

【００１５】ところで、バッテリ１には、バッテリ１に残っている電力容量の満充電量に対する割合（充電率）を検出する一般的な（周知の）残存容量検出手段２１と、バッテリ１の温度を検出する一般的な（周知の）バッテリ温度検出手段２２とが付設されており、バッテリ１にこれらの残存容量検出手段２１及びバッテリ温度検出手段２２を含めたものを蓄電池装置２０と称することにする。

【００１６】そして、このようなバッテリ１の劣化を判定するために、電池劣化判定部１１がそなえられている。この電池劣化判定部１１は、記憶手段１２，演算手段１３，判定手段１４，指示手段１５をそなえており、モータ１の出力を検出する電動機出力検出手段２３，アクセル開度等のドライバの出力操作状態を検出する操作状態検出手段２４及び蓄電池装置２０の残存容量検出手段２１，バッテリ温度検出手段２２からの各検出情報及びタイマ２５のタイマ情報に基づいて判定を行なうようになっている。

【００１７】なお、電動機出力検出手段２３は、例えばモータ１への供給電流値に基づいて検出することができる。記憶手段１２には、判定用の各種設定値が記憶されており、具体的には、第１設定値としてバッテリの残存容量に関する設定値（判定値）が記憶され、第２設定値としてバッテリの温度に関する設定値（判定値）が記憶され、第３設定値としてモータの実出力と指示出力との比の値（実出力／指示出力）に関する設定値（判定値）が記憶され、第４設定値としてモータの実出力に関する設定値（判定値）が記憶されている。

【００１８】演算手段１３には、第１演算手段１３Ａ及び第２演算手段１３Ｂが設けられている。第１演算手段１３Ａでは、操作状態検出手段２４による検出結果に基づいてモータ１に発生させる出力値である指示出力値を演算するもので、一般にはドライバの操作するアクセルペダルの開度（アクセル開度）に対応して指示出力値を算出しうる。第２演算手段１３Ｂでは、次式のように、電動機出力検出手段２３で検出された実出力値を指示出力値で除算して、指示出力値に対する実出力値の割合Ｒを演算する。

Ｒ＝実出力値／指示出力値

また、判定手段１４は、記憶手段１２に記憶された各判定値や演算手段１３による演算結果に基づいて、各劣化条件に関して判定を行なう。つまり、（ａ）バッテリの残存容量が第１設定値（残存容量判定値）よりも大きいか否かの判定、（ｂ）バッテリの温度が第２設定値（バッテリ温度判定値、例えは１０°Ｃ））よりも大きいか否かの判定、（ｃ）モータの実出力と指示出力との比の値Ｒ（実出力／指示出力）が第３設定値（実出力／指示出力の判定値）よりも小さいか否かの判定、（ｄ）モータの実出力が第４設定値（モータ実出力判定値）よりも小さい状態が所定時間（例えば３秒程度）以上連続しているか否かの判定がそれぞれ行なわれるようになっている。なお、（ｄ）の判定はタイマ２５のタイマ情報に基づいて行なわれる。

【００１９】このような各判定のうち、（ａ）のバッテリ残存容量の判定は従来のバッテリ劣化判定でも用いられた前提条件に関する判定であり、（ｂ）のバッテリ温度に関する判定は、冬季などバッテリ温度の低いときにはバッテリの内部抵抗が上昇するので、実際にはバッテリが劣化していなくても劣化判定条件が満たされてしまう場合があるのでこれを除外しようとするものである。

【００２０】また、（ｃ）モータの実出力と指示出力との比の値（割合）Ｒに関する判定及び（ｄ）モータの実出力に関する判定は、バッテリの劣化状態に関する判定であり、いずれもドライバの感じる感覚と劣化判定とを合わせるようにした判定条件である。このうち（ｃ）の判定について説明すると、バッテリが劣化するとその一つの現象としてモータの実出力がモータの指示出力まで達しなくなることがある。つまり、モータの指示出力に対してモータの実出力の割合Ｒが１よりも小さくなり、このようなモータの出力割合（実出力／指示出力）Ｒがある適度小さくなると、ドライバが出力不足を感じるよ

うになる。そこで、この出力の割合Ｒに関する判定値（第３設定値）を、このようにドライバが出力不足を感じて通常走行ができないと感じるような値に設定することで、（ｃ）の判定によりドライバの感じる感覚に応じながらバッテリが劣化していると判定することができる。特に、例えば登坂路等の車重の影響が加わる場合に、この判定によるバッテリ劣化判定が行なわれやすい。

【００２１】また、（ｄ）の判定について説明すると、バッテリが劣化するとその一つの現象としてモータの実出力の大きさ自体に限界が生じてくる。そこで、モータの実出力の大きさに対してドライバが出力不足を感じて通常走行ができないと感じるような値に実出力値に関する判定値（第４設定値）を設定することで、（ｄ）の判定によりドライバの感じる感覚に応じながらバッテリが劣化していると判定することができる。

【００２２】この判定手段１４では、（ａ），（ｂ）の判定でそれぞれ肯定の結果が得られる状況下で、（ｃ）の判定で、出力割合Ｒが設計値以下と判定され、且つ、（ｄ）の判定で、所定時間（例えば３秒程度）連続して実出力が設計値以下と判定された場合に、バッテリ１が劣化していると判定するようになっている。そして、指示手段１５では、判定手段１４でのバッテリ１の劣化判定を受けると、例えば警告ランプ等で構成された電池劣化の表示部１６に表示指示を出力するようになっている。

【００２３】本発明の第１実施形態としての電気自動車は、上述のように構成されているので、例えば図２に示すようなフローチャートに従って、バッテリの劣化を判定することができる。つまり、まず、イグニッションキー（ＩＧキー）オンの判定（ステップＡ１０）で、ＩＧキーがオンであれば判定制御を開始して、ステップＡ２０に進み、前回のＩＧキーがオフ前に電池劣化を表示しているか否かを判定して、電池劣化を表示していれば判定動作を行なわずに、指示手段１５を通じて電池劣化表示部１６にその旨（電池劣化）を表示させる（ステップＡ７０）。

【００２４】また、ステップＡ２０で、前回、電池劣化を表示していないと判定されると、次に、ステップＡ３０で、バッテリ１の残存容量（充電率）が設定値（第１設定値）よりも大きいか否かが判定される。充電率が設定値よりも大きくなければ正しい劣化判定はできないので判定は行なわない。充電率が設定値よりも大きければ、さらにステップＡ４０へ進み、バッテリ１の温度が設定値（第２設定値）よも大きいか否かが判定される。バッテリ温度が設定値よりも大きくなければ正しい劣化判定はできないので判定は行なわない。そして、バッテリ温度が設定値よりも大きければ、さらにステップＡ５０へ進み、モータ１の実出力と指示出力との比の値（実出力／指示出力）Ｒが第３設定値（実出力／指示出力の判定値）よりも小さいか否かの判定を行なう。

【００２５】ここで、（実出力／指示出力）Ｒが設定値よりも小さくなければ、バッテリは劣化していないと判定できる。一方、（実出力／指示出力）Ｒが設定値よりも小さければ、バッテリは劣化していると判定できるが、この場合、さらにステップＡ６０へ進み、モータ１の実出力が設定値よりも小さい状態が所定時間（例えば３秒）連続したか否かの判定が行なわれる。

【００２６】そして、ここで、モータ１の実出力が設定値よりも小さい状態が所定時間（例えば３秒）連続したと判定されなければ、バッテリが劣化していると結論できないので、今回の判定制御を終える。一方、モータ１の実出力が設定値よりも小さい状態が所定時間（例えば３秒）連続したと判定されれば、バッテリが劣化していると結論づけて、指示手段１５を通じて電池劣化表示部１６にその旨（電池劣化）を表示させる（ステップＡ７０）。

【００２７】なお、このようなフローチャートは、電池交換時には、リセットされるようになっており、電池交換後には、電池表示のない状態から劣化判定制御をスタートする。このように、本電気自動車では、（実出力／指示出力）Ｒや実出力自体といったドライバの意識と整合しやすいパラメータをバッテリの劣化判定に利用するので、バッテリの劣化判定がドライバが感じる感覚とマッチングするようになって、ドライバがバッテリの劣化表示に納得できるようになる。これにより、劣化したバッテリの交換をより速やかに行なうようドライバに訴えることができる。

【００２８】また、本実施形態では、（実出力／指示出力）Ｒに関する劣化条件と実出力自体に関する劣化条件とをＡＮＤ条件として、両者が共に成立したときにはじめて、バッテリが劣化していると判定しているので、それだけ誤判定のおそれが低減される。また、実出力自体に関する劣化条件については、実出力値が所定値以下の状態が所定時間以上継続した場合としているので、この点でも誤判定のおそれが低減される。

【００２９】また、バッテリ温度が低い場合に誤った劣化劣化判定が行なわれなくなるので、ドライバに誤解を与えるおそれもない。もちろん、判定値（各設定値）の設定や各パラメータの信頼度によっては、（実出力／指示出力）Ｒに関する劣化条件と実出力自体に関する劣化条件とをＯＲ条件として、いずれかの劣化条件が成立すればバッテリが劣化していると判定するなど、条件（ａ），（ｂ），（ｃ），（ｄ）を部分的に組み合わせたり、また、ＡＮＤ条件とするほかＯＲ条件とするなど種々の判定条件が考えられる。

【００３０】また、実出力値が所定値以下である劣化条件の判定について、判定の信頼性を確保するには、実出力値が所定値以下の状態が所定時間以上継続した場合とするのが好ましいが、この場合の継続時間の判定値は本

実施形態のように３秒程度に限定されるものではない。

次に、本発明の第２実施形態について説明すると、この実施形態では、電池温度とモータの実出力との関係を利用して、より精度のよいバッテリ劣化判定を行なおうとするものであり、このバッテリ劣化判定の一部を除いて、図１に示すに第１実施形態と同様に構成されるので、第１実施形態と異なる点についてのみ説明する。

【００３１】つまり、本実施形態の電気自動車における電池劣化判定部１１の判定手段１４では、以下のような各条件を同時に満たした場合に、バッテリが劣化していると判定するようになっている。つまり、（ａ）バッテリの残存容量が第１設定値（残存容量判定値）よりも大きく、且つ、（ｃ）モータの実出力と指示出力との比の値Ｒ（実出力／指示出力）が第３設定値（実出力／指示出力の判定値）よりも小さく、且つ、（ｅ）モータの実出力がバッテリの温度に応じた第４設定値（モータ実出力判定値）よりも小さい状態が所定時間（例えば３秒）継続した場合に、バッテリが劣化していると判定する。

【００３２】上述の条件（ａ），（ｃ）は第１実施形態と同様であり、条件（ｅ）は第１実施形態における条件（ｂ），（ｄ）を複合したものとなっている。ここで、条件（ｅ）を説明すると、この条件（ｅ）の判定のためには、まず、第４設定値（モータ実出力判定値）をバッテリの温度に応じて決定する。つまり、図３に示すように、モータ実出力は、バッテリ温度と対応する特性がある。なお、図３中、特性線Ａは鉛電池に関し、特性線Ｂはニッケル系電池に関する。

【００３３】このような特性をマップ又はテーブルにして記憶手段１２に記憶しておくことで、バッテリ温度に基づいて第４設定値（モータ実出力判定値）を設定することができる。このように、第４設定値（モータ実出力判定値）が設定されたら、モータの実出力に基づいて条件（ｅ）の判定を行なうことができる。

【００３４】本発明の第２実施形態としての電気自動車は、上述のように構成されているので、例えば図４に示すようなフローチャートに従って、バッテリの劣化を判定することができる。つまり、まず、イグニッションキー（ＩＧキー）オンの判定（ステップＢ１０）で、ＩＧキーがオンであれば判定制御を開始して、ステップＢ２０に進み、前回のＩＧキーがオフ前に電池劣化を表示しているか否かを判定して、電池劣化を表示していれば判定動作を行なわずに、指示手段１５を通じて電池劣化表示部１６にその旨（電池劣化）を表示させる（ステップＢ７０）。

【００３５】また、ステップＢ２０で、前回、電池劣化を表示していないと判定されると、次に、ステップＢ３０で、バッテリ１の残存容量（充電率）が設定値（第１設定値）よりも大きいか否かが判定される。充電率が設定値よりも大きくなければ正しい劣化判定はできないので判定は行なわない。充電率が設定値よりも大きければ、さらにステップＢ４０へ進み、モータ１の実出力と指示出力との比の値（実出力／指示出力）Ｒが第３設定値（実出力／指示出力の判定値）よりも小さいか否かの判定を行なう。

【００３６】ここで、（実出力／指示出力）Ｒが設定値よりも小さくなければ、バッテリは劣化していないと判定できる。一方、（実出力／指示出力）Ｒが設定値よりも小さければ、バッテリは劣化していると判定できるが、この場合、さらにステップＢ５０へ進み、バッテリ１の温度に基づいて第４設定値（モータ実出力判定値）を演算して設定し、さらにステップＢ６０へ進み、モータ１の実出力が、ステップＢ５０で設定された第４設定値（モータ実出力判定値）よりも小さい状態が所定時間（例えば３秒）連続したか否かの判定が行なわれる。

【００３７】そして、ここで、モータ１の実出力が設定値よりも小さい状態が所定時間（例えば３秒）連続したと判定されなければ、バッテリが劣化していると結論できないので、今回の判定制御を終える。一方、モータ１の実出力が設定値よりも小さい状態が所定時間（例えば３秒）連続したと判定されれば、バッテリが劣化していると結論づけて、指示手段１５を通じて電池劣化表示部１６にその旨（電池劣化）を表示させる（ステップＢ７０）。

【００３８】なお、このようなフローチャートは、電池交換時には、リセットされるようになっており、電池交換後には、電池表示のない状態から劣化判定制御をスタートする。このように、本電気自動車でも、（実出力／指示出力）Ｒや実出力自体といったドライバの意識と整合しやすいパラメータをバッテリの劣化判定に利用するので、バッテリの劣化判定がドライバが感じる感覚とマッチングするようになって、ドライバがバッテリの劣化表示に納得できるようになる。これにより、劣化したバッテリの交換をより速やかに行なうようドライバに訴えることができる。

【００３９】また、本実施形態では、（実出力／指示出力）Ｒに関する劣化条件と実出力自体に関する劣化条件とをＡＮＤ条件として、両者が共に成立したときにはじめて、バッテリが劣化していると判定しているので、それだけ誤判定のおそれが低減される。また、実出力自体に関する劣化条件については、実出力値が所定値以下の状態が所定時間以上継続した場合としているので、この点でも誤判定のおそれが低減される。

【００４０】また、第４設定値（モータ実出力判定値）がバッテリの特性に基づいてバッテリ温度に応じて設定されるので、劣化判定がより精度良くしかもドライバの感覚に合わせて行なわれる利点がある。また、バッテリ温度が低い場合に誤った劣化劣化判定が行なわれなくなるので、ドライバに誤解を与えるおそれもない。

【００４１】もちろん、本実施形態でも、判定値（各設定値）の設定や各パラメータの信頼度によっては、（実

出力／指示出力）Ｒに関する劣化条件と実出力自体に関する劣化条件とをＯＲ条件として、いずれかの劣化条件が成立すればバッテリが劣化していると判定するなど、条件（Ａ），（Ｂ），（Ｅ）を部分的に組み合わせたり、また、ＡＮＤ条件とするほかＯＲ条件とするなど種々の判定条件が考えられる。

【００４２】また、本実施形態でも、実出力値が所定値以下である劣化条件の判定について、判定の信頼性を確保するには、実出力値が所定値以下の状態が所定時間以上継続した場合とするのが好ましいが、この場合の継続時間の判定値は本実施形態のように３秒程度に限定されるものではない。また、本電気自動車によるバッテリの劣化判定は、図１に示すような構成の電気自動車に限定されること無く、変速機をそなえない電気自動車や種々のハイブリッド電気自動車等各種の電気自動車に適用しうる。

【００４３】

【発明の効果】以上詳述したように、請求項１記載の本発明の電気自動車によれば、車両に搭載されているバッテリを有する蓄電池装置と、該バッテリに電気的に接続されるとともに出力軸を該車両の駆動輪に連結された電動機と、をそなえた電気自動車において、該電動機に発生する実出力の値を検出する電動機出力検出手段と、該車両の運転者の操作状態を検出する操作状態検出手段と、該操作状態検出手段による検出結果に基づいて該電動機に発生させる出力値である指示出力値を演算する第１演算手段と、該指示出力値に対する該実出力値の割合を演算する第２演算手段と、該実出力値と該割合とに基づいて該バッテリの劣化度合を判定する判定手段とが設けられるという構成により、バッテリの劣化判定をドライバの感覚に合わせて行なうことができるようになり、ドライバにバッテリの劣化表示等を納得させることができるようになる。これにより、劣化したバッテリの交換をより速やかに行なうようドライバに促進することができる利点がある。

【００４４】請求項２記載の本発明の電気自動車によれば、請求項１記載の構成において、該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段を有し、該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上である場合に、該劣化度合の判定を実施するという構成により、バッテリの劣化判定を誤判定を生じることなく精度よく行なうことができるようになる利点がある。

【００４５】請求項３記載の本発明の電気自動車によれば、請求項１記載の構成において、該蓄電池機構が、該バッテリの温度を検出するバッテリ温度検出手段を有し、該判定手段が、該バッテリ温度検出手段で検出された温度値が予め設定された第２設定値以上である場合に、該劣化度合の判定を実施するという構成により、バッテリの劣化判定を誤判定を生じることなく精度よく行なうことができるようになる利点がある。

【００４６】請求項４記載の本発明の電気自動車によれば、請求項１記載の構成において、該判定手段が、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定するという構成により、バッテリの劣化判定をドライバの感覚に合わせて、しかも精度よく行なうことができるようになる。

【００４７】請求項５記載の本発明の電気自動車によれば、請求項４記載の構成において、該第４設定値が、該バッテリ温度検出手段で検出された温度値に基づいて定められるという構成により、バッテリの劣化判定をドライバの感覚に合わせて、しかもより精度よく行なうことができるようになる。請求項６記載の本発明の電気自動車によれば、請求項１記載の構成において、該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段と、該バッテリの温度を検出するバッテリ温度検出手段とを有し、該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上で、且つ、該バッテリ温度検出手段で検出された温度値が予め設定された第２設定値以上で、且つ、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定するという構成により、バッテリの劣化判定をドライバの感覚に合わせて、しかも精度よく行なうことができるようになる。これにより、ドライバにバッテリの劣化表示等を納得させることができるようになり、劣化したバッテリの交換をより速やかに行なうようドライバに促進することができる。

【００４８】請求項７記載の本発明の電気自動車によれば、請求項１記載の構成において、該蓄電池機構が、該バッテリに蓄電されている電気の残存容量を検出する残存容量検出手段と、該バッテリの温度を検出するバッテリ温度検出手段とを有し、該判定手段が、該残存容量検出手段で検出された残存容量値が予め設定された第１設定値以上で、且つ、該割合が予め設定された第３設定値以下で、且つ、該実出力値が予め設定された第４設定値以下である場合に、該バッテリが劣化していると判定するという構成により、バッテリの劣化判定をドライバの感覚に合わせて精度よく行なうことができるようになる。これにより、ドライバにバッテリの劣化表示等を納得させることができるようになり、劣化したバッテリの交換をより速やかに行なうようドライバに促進することができる。

【００４９】請求項８記載の本発明の電気自動車によれば、請求項４～７のいずれかに記載の構成において、該判定手段が、該実出力値が所定時間連続して該第４設定値以下である場合に、該バッテリが劣化していると判定

するという構成により、バッテリの劣化判定を誤判定を生じることなく精度よく行なうことができるようになる利点がある。

【００５０】請求項９記載の本発明の電気自動車によれば、請求項８記載の構成において、該所定時間は、好ましくは３秒程度の時間であるという構成により、バッテリの劣化判定を誤判定を生じることなく精度よくしかも速やかに行なうことができるようになる利点がある。請求項１０記載の本発明の電気自動車によれば、請求項１記載の構成において、該判定手段により該バッテリが劣化していることが判定されるとこの判定結果を表示する表示手段が設けられるという構成により、劣化したバッテリの交換をより速やかに行なうようドライバに促進することができる。

【００５１】請求項１１記載の本発明の電気自動車によれば、請求項１０記載の構成において、該判定手段が、該車両に設けられたイグニッションキースイッチがオン状態のときに該判定を行なうように構成されるとともに、該バッテリが劣化している旨の判定結果を記憶する判定結果記憶部を有し、該イグニッションキースイッチのオフからオン状態への切換時に、該判定結果記憶部に前回のオフ切換前に該バッテリが劣化している旨の判定結果が記憶されている時には、該判定動作を行なわずに、該表示手段に該バッテリが劣化している旨を表示させるように構成されるという構成により、バッテリの劣化判定をより簡素に効率よく行なえるようになる。

【図面の簡単な説明】

【図１】本発明の第１実施形態としての電気自動車の要部構成を模式的に示すブロック図である。

【図２】本発明の第１実施形態としての電気自動車の電池劣化判定の手順を示すフローチャートである。

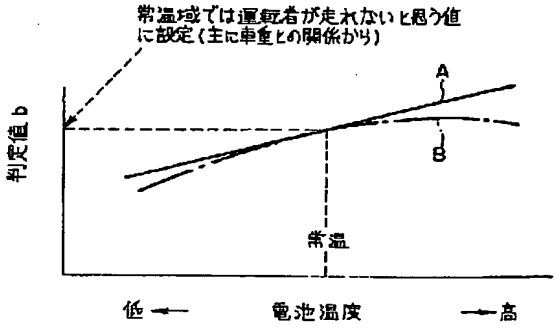
【図３】本発明の第２実施形態としての電気自動車の電池劣化判定について説明する図である。

【図４】本発明の第２実施形態としての電気自動車の電池劣化判定の手順を示すフローチャートである。

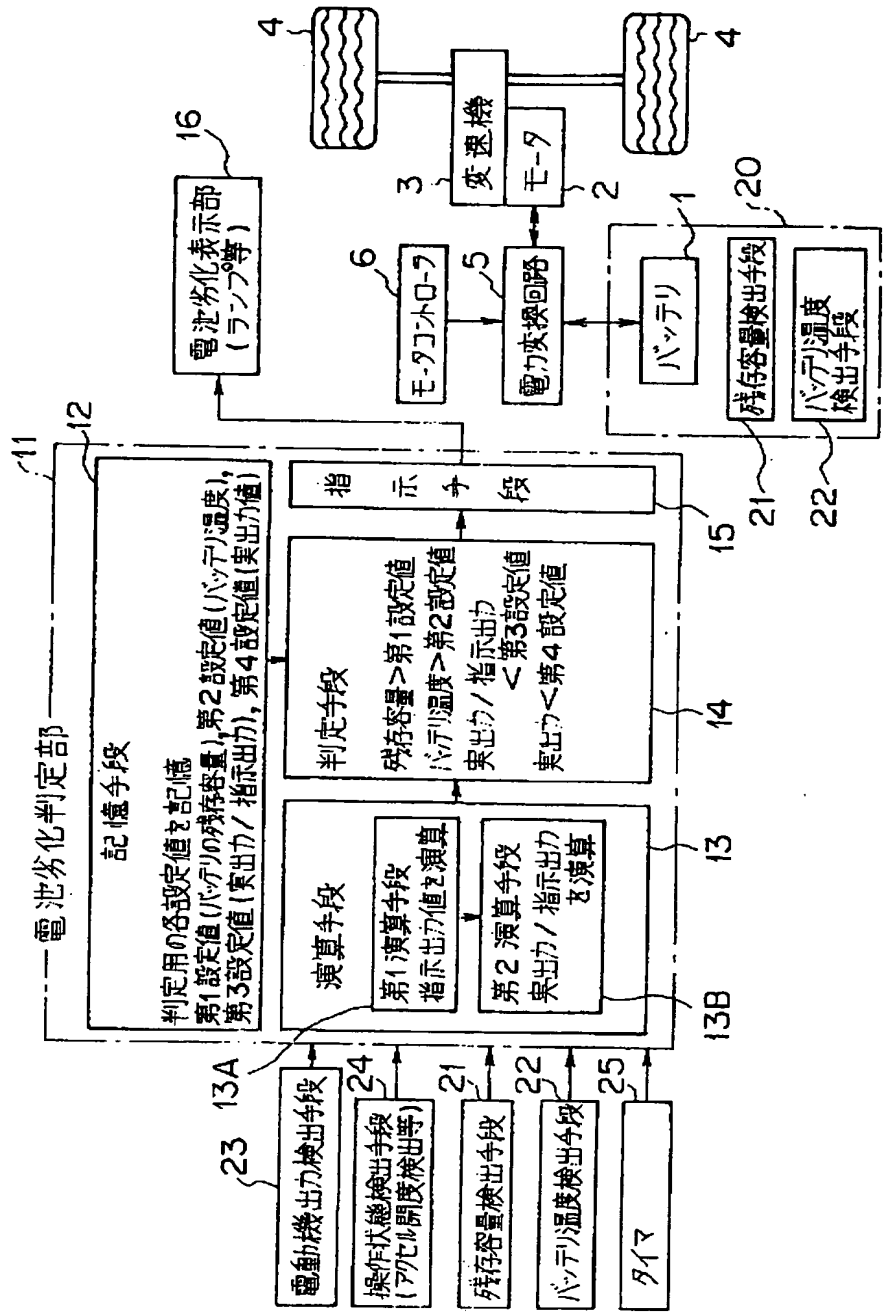
【符号の説明】

１　バッテリ
２　電動機（走行用モータ）
３　変速機
４　駆動輪
５　電力変換回路
６　モータコントローラ
１１　電池劣化判定部
１２　記憶手段
１３　演算手段
１３Ａ　第１演算手段
１３Ｂ　第２演算手段
１４　判定手段
１５　指示手段
２０　蓄電池装置
２１　残存容量検出手段
２２　バッテリ温度検出手段
２３　電動機出力検出手段
２４　操作状態検出手段
２５　タイマ

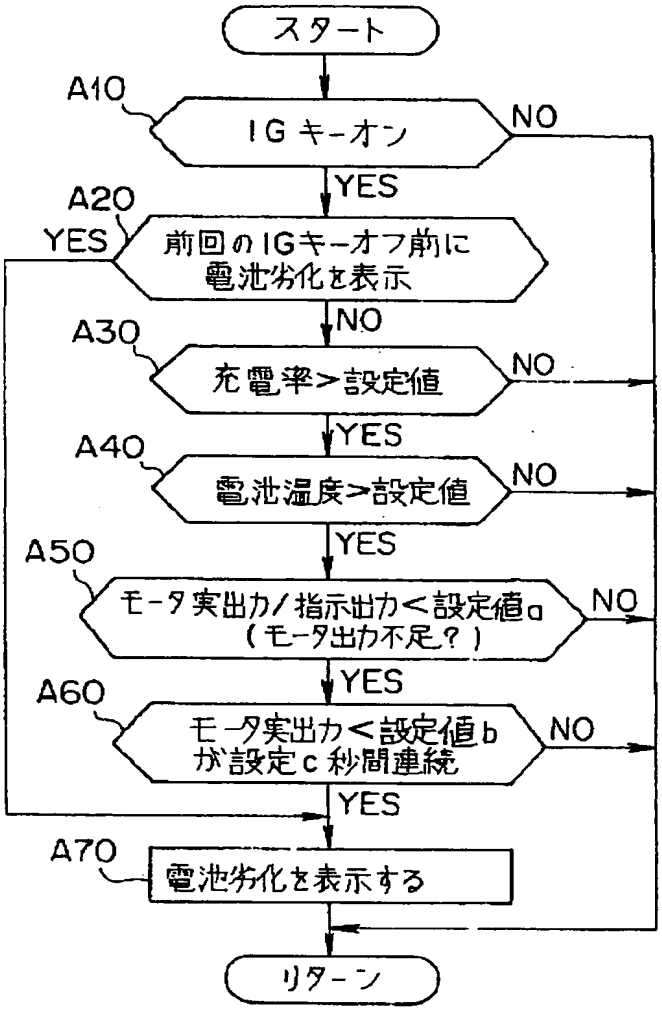
【図３】



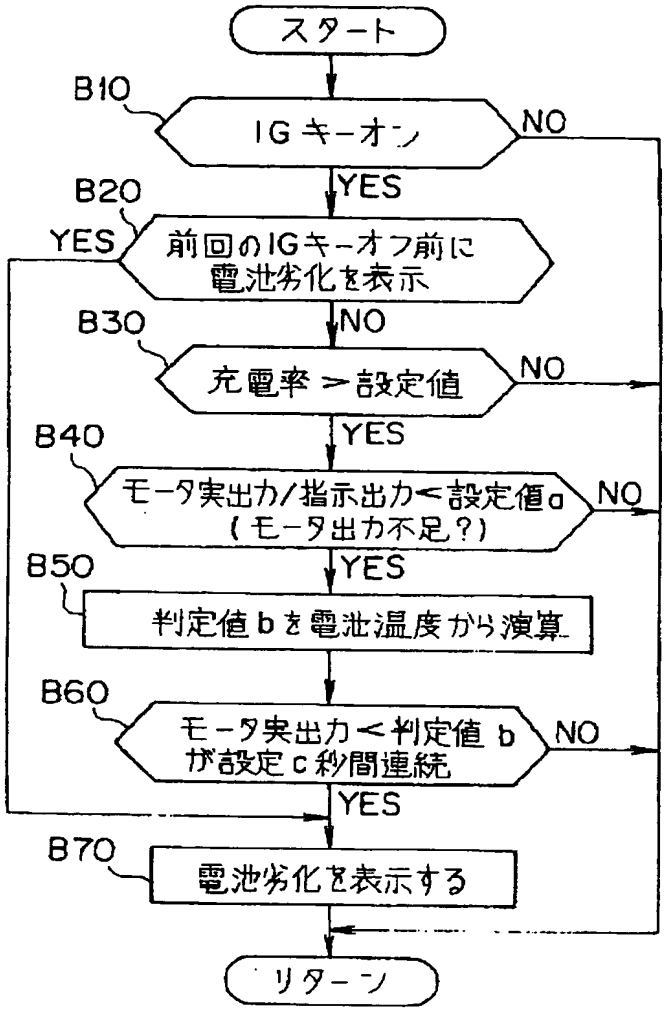
【図1】


電池劣化判定部
記憶手段
判定用の各設定値を記憶
第1設定値(バッテリの残存容量),第2設定値(バッテリ温度),
第3設定値(実出力/指示出力),第4設定値(実出力値)
演算手段
第1演算手段
指示出力値を演算
第2演算手段
実出力/指示出力
を演算
判定手段
残存容量>第1設定値
バッテリ温度>第2設定値
実出力/指示出力
<第3設定値
実出力<第4設定値
指示手段
電動機出力検出手段
操作状態検出手段
(アクセル開度検出等)
残存容量検出手段
バッテリ温度検出手段
タイマ
電池劣化表示部
(ランプ等)
モータコントローラ
電力変換回路
変速機
モータ
バッテリ
残存容量検出手段
バッテリ温度
検出手段
11
12
13
13A
13B
14
15
16
20
21
22
23
24
25
1
2
3
4
5
6

【図２】


スタート
A10
IGキーオン
NO
YES
A20
YES
前回のIGキーオフ前に
電池劣化を表示
NO
A30
充電率＞設定値
NO
YES
A40
電池温度＞設定値
NO
YES
A50
モータ実出力／指示出力＜設定値α
（モータ出力不足？）
NO
YES
A60
モータ実出力＜設定値b
が設定c秒間連続
NO
YES
A70
電池劣化を表示する
リターン

【図４】


スタート
B10
IGキーオン
NO
YES
B20
YES
前回のIGキーオフ前に
電池劣化を表示
B30
NO
充電率＞設定値
NO
YES
B40
モータ実出力/指示出力＜設定値a
(モータ出力不足?)
NO
YES
B50
判定値bを電池温度から演算
B60
モータ実出力＜判定値b
が設定c秒間連続
NO
YES
B70
電池劣化を表示する
リターン